WO 2005/086332 PCT/KR2005/000331

Claims

A digital DC-DC converter using digital modulation, comprising:

a PWM generator for converting an input DC voltage to a DC voltage of a preset level according to an input PWM signal;

a conversion portion for converting the DC voltage output from the PWM generator to a voltage of a preset level;

a delta-sigma modulator for converting a feedback voltage Vfd corresponding to

the output voltage of the conversion portion to a 1-bit digital voltage according to a preset reference voltage; a counter for counting logic 1's included in 1-bit digital voltage signals output

from the delta-sigma modulator on a predetermined bit-unit basis; and a delay controller for controlling a high-level delay time according to the number of logic 1's counted by the counter, and transferring a PWM signal having the controlled high-level delay time to the PWM generator.

[2] The converter as set forth in claim 1, wherein the delta-sigma modulator comprises:

a switched capacitor portion for performing switching according to first and second non-overlapping clock signals having two phases, so as to sample each of the feedback voltage and an output voltage of the D/A converter; an integrator for integrating each of the voltages sampled by the switched

capacitor portion;

a comparator for comparing a voltage output from the integrator with the preset reference voltage, and outputting a 1-bit digital voltage having a logic state "1" or "0"; and

a D/A converter for converting the digital voltage output from the comparator to a preset analog voltage according to the logic state of the digital voltage output from the comparator, and transferring the preset analog voltage to the switched capacitor portion.

The converter as set forth in claim 2, wherein the switched capacitor portion comprises:

[3]

a first switch turned on/off according to the first clock signal to selectively connect the capacitor with an input terminal of the switched capacitor portion, the feedback voltage being received through the input terminal;

a second switch connected with the first switch via the capacitor, the second switch being turned on/off according to the first clock signal to selectively connect the capacitor with the reference voltage;

a third switch turned on/off according to the second clock signal to selectively

WO 2005/086332 PCT/KR2005/000331

connect a connection node between the first switch and the capacitor with the output of the D/A converter; and

a fourth switch turned on/off according to the second clock signal to selectively connect the capacitor with an output terminal of the switched capacitor portion, the output terminal being connected with the integrator.

[4]

The converter as set forth in claim 2, wherein if the digital voltage output from the comparator has a logic state "1", the D/A converter converts the output digital voltage to a preset negative analog voltage, and transfers the preset negative analog voltage to the switched capacitor portion, and if the digital voltage output from the comparator has a logic state "0", the D/A converter converts the output digital voltage to a preset positive analog voltage, and transfers the preset positive analog voltage to the switched capacitor portion.